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Muhs et al.

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(54) **WET RESILIENT ABSORBENT ARTICLE**

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This patent is subject to a terminal disclaimer.

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(51) **Int. Cl.**[7] **A61F 13/15**

(52) **U.S. Cl.** **604/374**; 604/378; 604/385.01

(58) **Field of Search** 604/378, 374, 604/385.01, 379, 380

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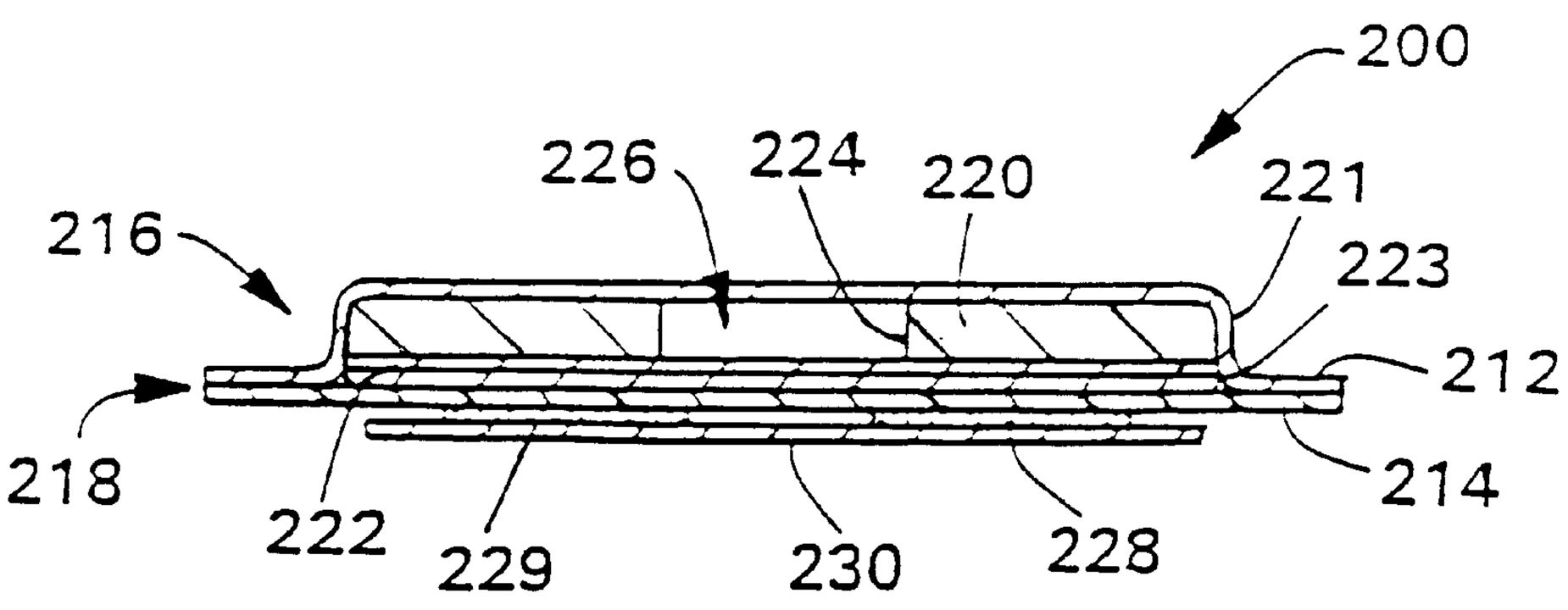
(57) **ABSTRACT**

Disclosed is an absorbent article, such as a disposable diaper, incontinent pad, sanitary napkin and the like that has as a component of the absorbent core a fluff cellulosic material. The absorbent core is especially effective and efficient for absorbing body fluids contacting the surface of the absorbent article. The absorbent core comprises a first absorbent layer having a fluff cellulosic material and a second absorbent layer of a resilient cellulosic material. The first absorbent layer can have an acquisition orifice so the second absorbent layer can quickly acquire any discharged body fluids. The absorbent article exhibits excellent wet crush recovery substantially without the use of polymeric or polyolefinic materials in either of the absorbent layers. The absorbent core when laterally crushed to approximately 40% of its initial dimension will recover to at least about 70% of its initial, precrushed dimension.

17 Claims, 3 Drawing Sheets



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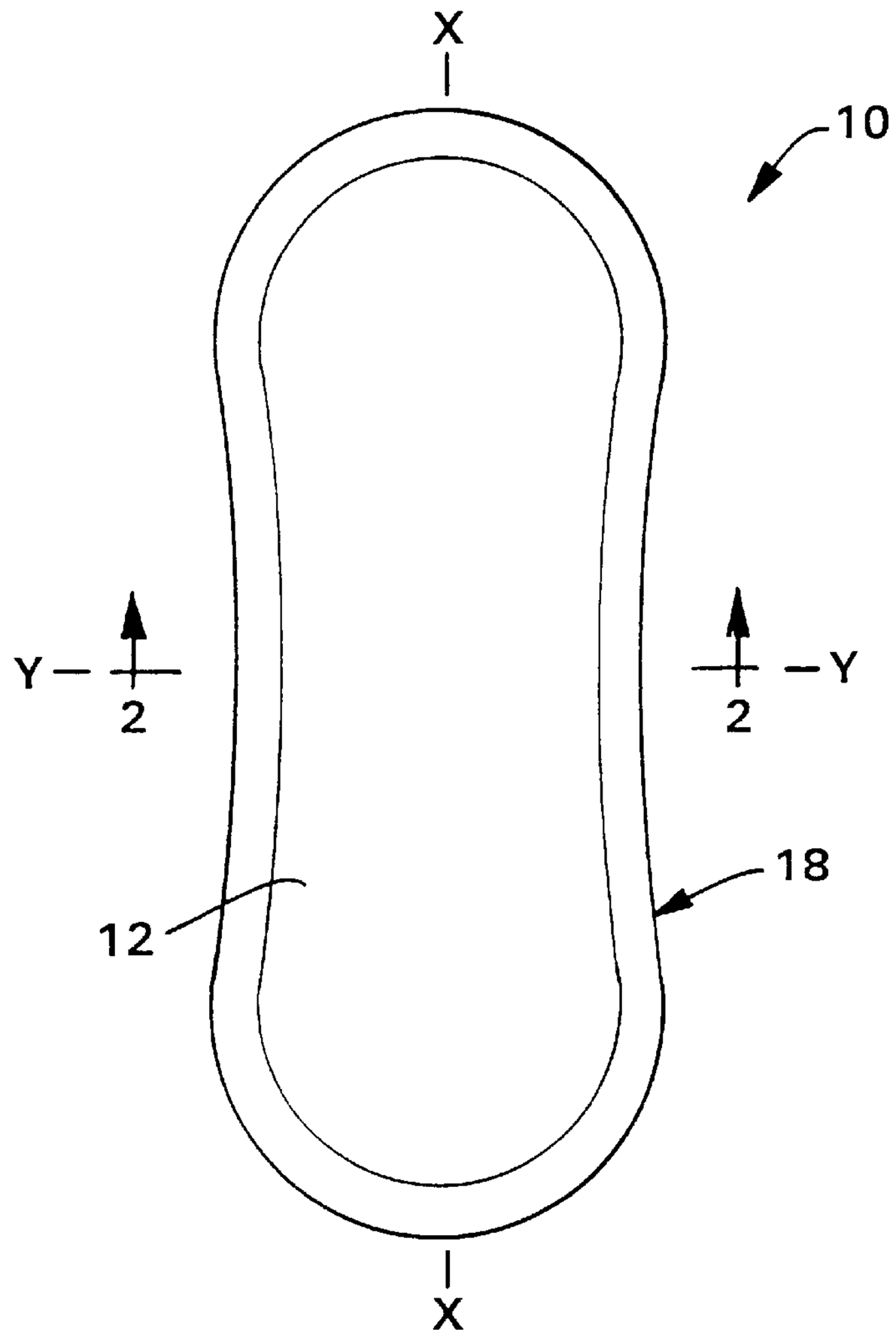

FIG. 1

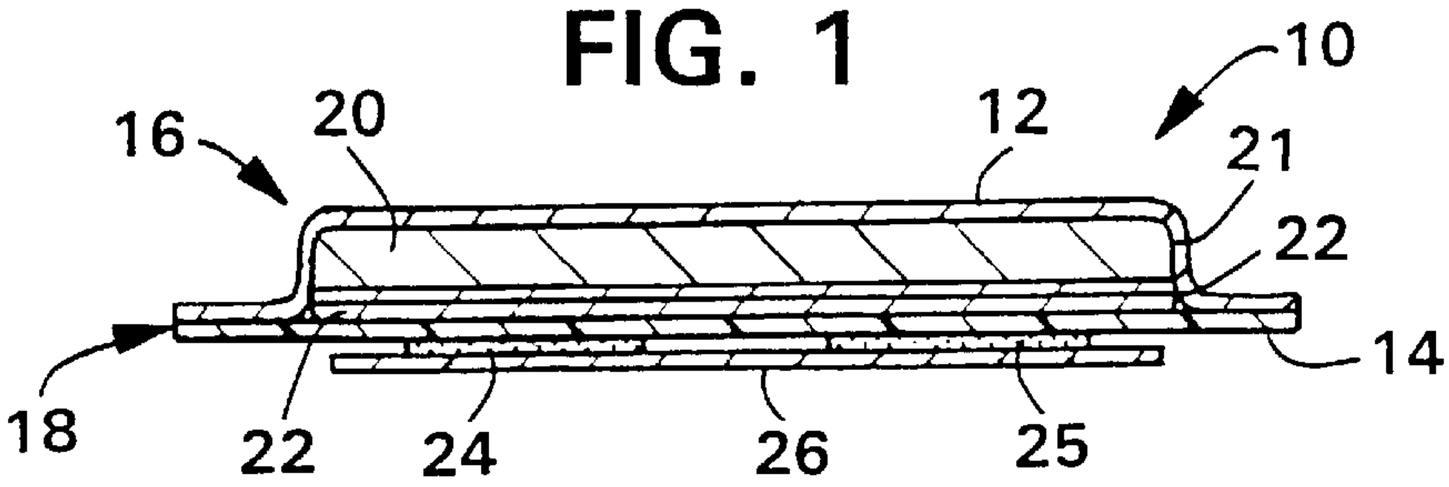

FIG. 2

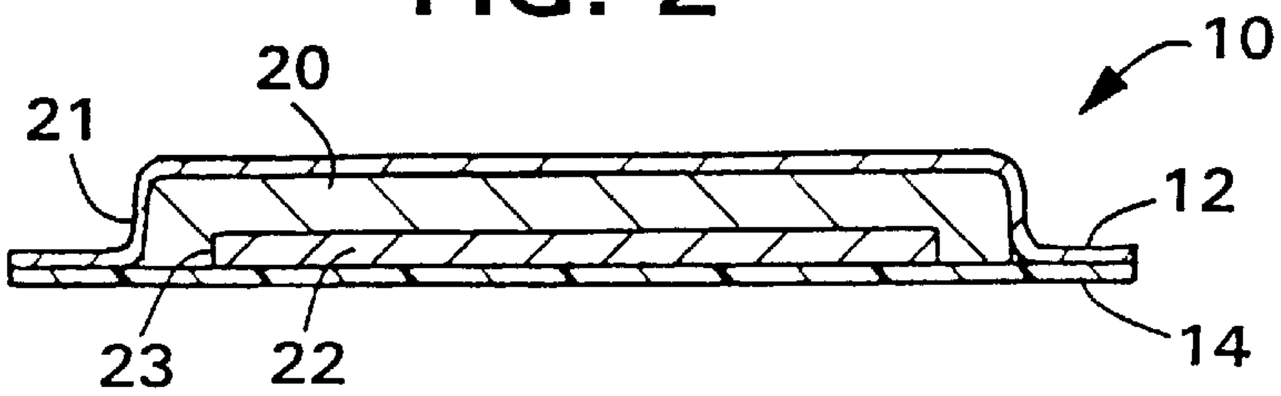

FIG. 3

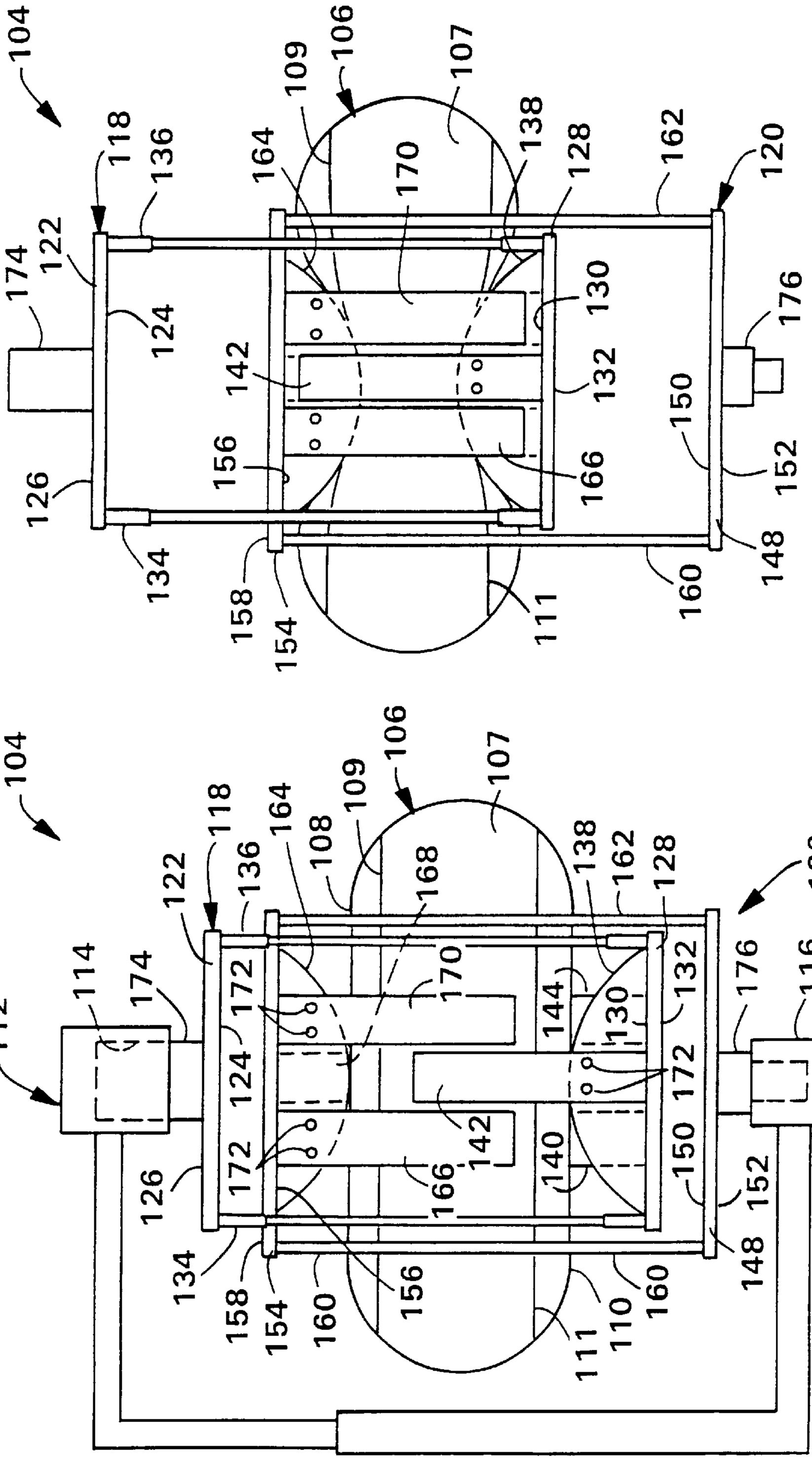
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FIG. 4

FIG. 5

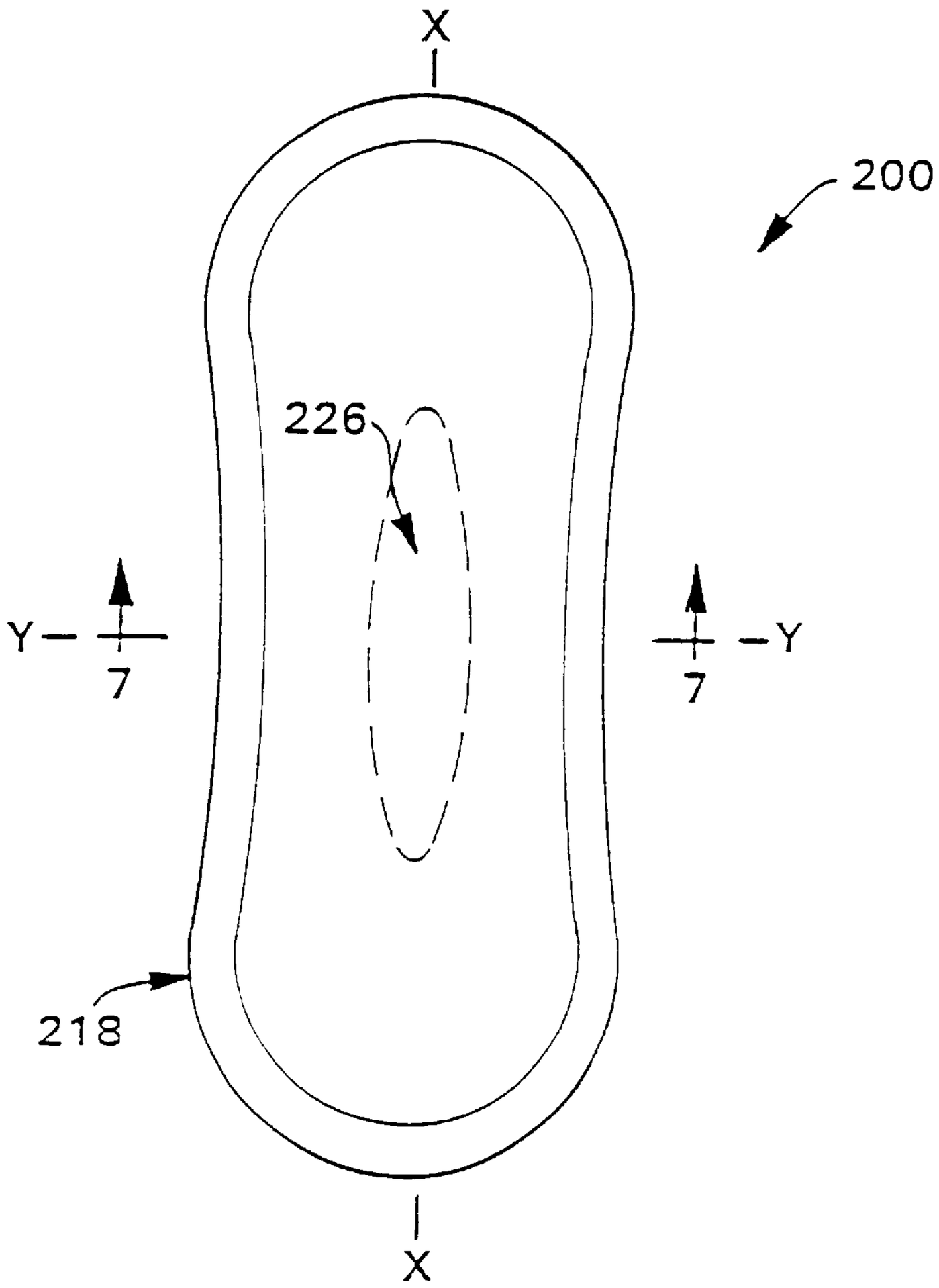
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FIG. 6

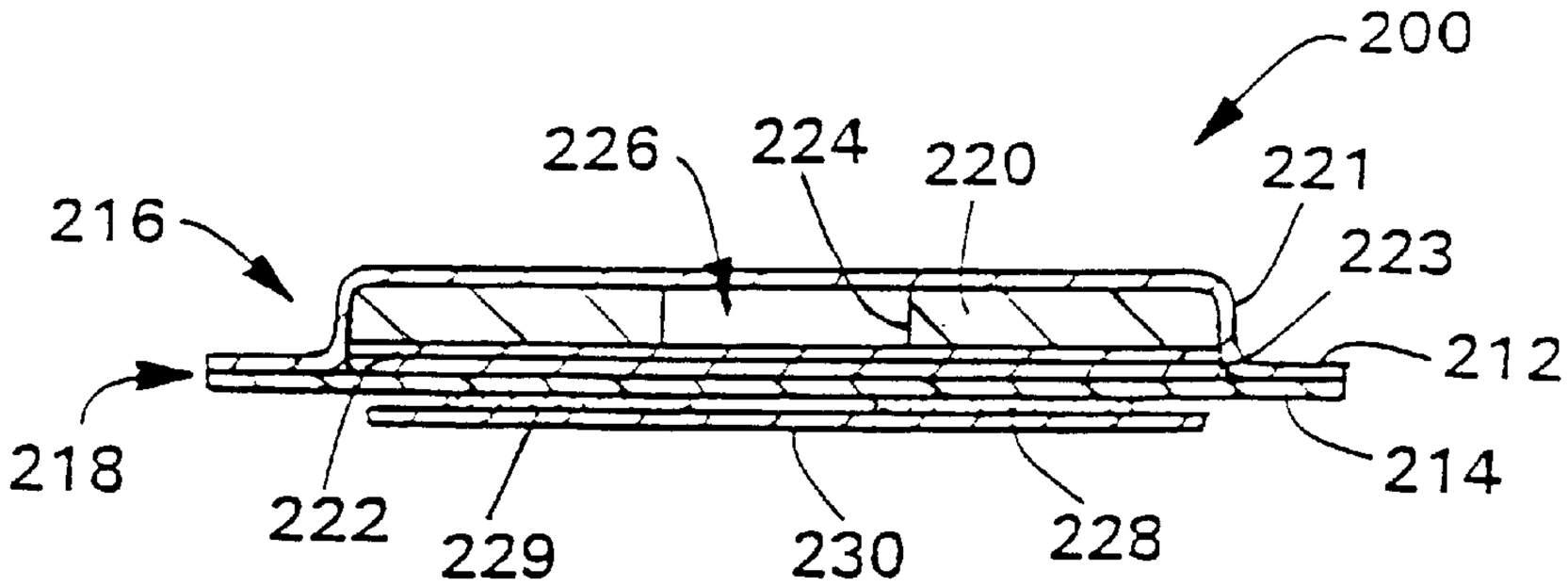
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FIG. 7

WET RESILIENT ABSORBENT ARTICLE

The present application is a Continuation of application Ser. No. 08/720,959, now U.S. Pat. No. 6,011,195, filed Oct. 10, 1996.

FIELD OF THE INVENTION

This invention relates to a disposable absorbent article and particularly to a sanitary napkin having an improved absorbent core that effectively and efficiently acquires and distributes fluids absorbed therein. More specifically, the invention relates to a sanitary napkin having a multi-layered absorbent core with at least one of the layers having a resilient cellulosic material exhibiting excellent wet crush recovery.

BACKGROUND OF THE INVENTION

The present invention relates to disposable absorbent articles, such as diapers, sanitary napkins, training pants, incontinent garments, overnight pads, panty liners, underarm shields, as well as other absorbent devices used for medical purposes, such as, surgical absorbents which utilize, to some degree, fluffed wood pulp fibers. Such articles are designed to absorb body fluids, such as urine, menses, blood, perspiration and other excrement discharged by the body. In order for such absorbent articles to function efficiently, the absorbent core must quickly absorb into the structure body fluids insulting its surface, retain the body fluid within the absorbent core and prevent body fluids from being discharged onto the person and/or the wearer's adjacent clothing.

The basic form of the absorbent article is well known and typically includes a bodyside, liquid-permeable cover, a garment-side, liquid-impermeable baffle and an absorbent core positioned between the cover and the baffle. Numerous variations of the elements in addition to the basic cover, baffle and absorbent core arrangement are known. Each additional element is usually directed to improving a specific characteristic of the absorbent article. Generally, on the larger absorbent articles, i.e. those designed to absorb and retain at least 20 grams of fluid, such as diapers, training pants, incontinent garments, overnight pads and maxi sanitary napkins, the absorbent core incorporates an absorbent batt that is used to absorb and retain the body fluids. This batt, sometimes referred to as "wadding", is composed of one or more layers of fluffed wood pulp and typically has a substantial thickness, that is, greater than about 5 millimeters. Advantageously, the fluffed wood pulp layer is quite soft, flexible, and comfortable. However fluffed wood pulp has a disadvantage of poor in-plane wicking ability. Since the fluid to be absorbed is usually deposited in a localized area within the absorbent batt the fluff wood pulp does not efficiently transport body fluids for effective utilization of absorbent article absorbent capacity.

Another disadvantage of the fluffed wood pulp is that it has a low wet resiliency or a low wet stability. This allows the batt to collapse when wet, exacerbating low in plane fluid distribution, enhancing the probability that the absorbent article will sag, clump-up, bunch, twist or rope. To overcome these disadvantages it is known in the absorbent art to incorporate into a fluffed wood pulp batt a moisture stable material such as a polymeric material. Although these polymeric materials provide a wet stability to the batt they are generally hydrophobic. To obtain a satisfactory wet stability it usually requires a substantial amount of the polymeric material, relative to the amount of pulp, be

incorporated into the batt which impedes the fluid distribution and capacity of the fluffed wood pulp batt.

Improving the performance of a disposable absorbent article which utilizes a fluffed wood pulp absorbent batt continues to be a formidable undertaking, although a number of improvements have been made in both the materials used and its construction. Improving fluid handling performance and wet resiliency protection without compromising comfort and fit has not yet met the desired needs of the consumer.

SUMMARY OF THE INVENTION

Briefly, this invention relates to an absorbent article having a liquid permeable cover, a liquid impermeable baffle and an absorbent core positioned between the cover and the baffle. The absorbent core has at least two layers of an absorbent material. The first absorbent layer comprises substantially a fluff wood pulp having an acquisition orifice therein. The acquisition orifice is configured to have a ratio of the length dimension to width dimension greater than unity. The second absorbent layer is one or more layers of a wet resilient, cellulosic material. This combination provides an absorbent article having greater absorbent utilization, is very comfortable and provides an absorbent core with an wet crush width recovery of greater than about 70 percent.

The general object of this invention is to provide an absorbent article having an absorbent core that is highly effective and efficient in rapidly acquiring and containing fluids. A more specific object of this invention is to provide a sanitary napkin having at least two absorbent layers with an acquisition orifice in the absorbent layer proximate the cover.

It is another object of the invention is to provide a sanitary napkin having a wet resilient, cellulosic absorbent material as that is especially effective in acquiring, distributing, and storing fluid insults.

Another object of the invention is to provide a sanitary napkin having an absorbent Core with a width recovery of greater than about 70 percent when the absorbent core is loaded with 25 milliliters of water and laterally compressed to 40% of its preloaded and precrushed dimension.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view of an absorbent article, illustrated as a sanitary napkin, having a multi-layered absorbent structure.

FIG. **2** is a cross-sectional view of the absorbent article taken along the transverse line 2—2 of FIG. **1**.

FIG. **3** is a cross-sectional view of another embodiment of the absorbent article taken along the transverse similar to line 2—2 of FIG. **1**.

FIG. **4** is a front elevational view of an apparatus in an open position depicting a non-crushed absorbent article positioned between first and second frame members and attached to a tester.

FIG. **5** is a front elevational view of the apparatus in a closed position depicting the absorbent article having been crushed sideways between first and second frame members.

FIG. **6** is a top plan view of another embodiment of the invention illustrating an acquisition orifice in the top most absorbent layer for rapid fluid acquisition.

FIG. **7** is a cross-sectional view of the absorbent article taken along line 7—7 of FIG. **6**.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the Figures, where like numerals indicate like parts throughout the several views and embodiments, in

FIGS. **1** and **2**, a disposable absorbent article **10** is depicted as a sanitary napkin. As used herein, the term "disposable absorbent article" refers to articles which absorb and retain body exudates and which are typically placed against or in proximity to the body of the wearer to absorb and contain various exudates discharged from the body, and which are intended to be discarded after a single use. A sanitary napkin is designed to be worn by a woman to absorb body fluids such as menses, blood, urine and other excrements. A sanitary napkin is also referred to as a catamenial pad or a feminine pad. Although the absorbent article **10** will be described with reference to a sanitary napkin, it can also encompass other articles such as an incontinent garment, incontinent shields, and the like which incorporate a fluffed wood pulp absorbent. Furthermore, the sanitary napkin **10** can be used either alone or in combination with underwear, menstrual panties, or specially designed belts, straps or harnesses.

The sanitary napkin **10** can include a liquid-permeable cover **12**, a liquid-impermeable baffle **14** and an absorbent core **16** positioned between the cover **12** and the baffle **14**. FIG. **1** shows a preferred embodiment of the sanitary napkin **10** in which the cover **12** and baffle **14** extend beyond the absorbent core **16** in a contiguous relationship and are sealed together to define a periphery **18** of the sanitary napkin **10**. The cover **12** and the baffle **14** may be sealed together using any suitable means that will not leave a hard, uncomfortable residue that may be annoying to the wearer. As used herein, the term "sealed" encompasses configurations whereby the cover **12** is directly joined to baffle **14** and configurations whereby the cover **12** is indirectly joined to the baffle **14** by affixing each to an intermediate member. Methods for attaching the cover **12** and baffle **14** are well known to those skilled in the art and include the use of hot melt-adhesives, pressure-sensitive adhesives, double-sided tape, sonic bonding, heat sealing and the like.

The sanitary napkin **10** includes a central longitudinal x-axis, denoted X—X, and a central transverse y-axis, denoted Y—Y. The transverse y-axis is perpendicularly orientated relative to the longitudinal x-axis. The sanitary napkin **10** has a length, measured along the longitudinal axis X—X, of between about 150 mm to about 300 mm and a width, measured along the transverse y-axis Y—Y, of between about 50 mm to about 125 mm. The sanitary napkin **10** generally has a hourglass shape but is not limited to this shape. Non-limiting examples of other shapes include rectangular, oval shape, dogbone, or racetrack.

Looking at the individual components in greater detail, the cover **12** is designed to contact the body of the wearer so should be soft feeling, compliant and non-irritating to the wearer's skin. The cover **12** should be liquid permeable and easily penetrated by body fluids. The cover **12** can be constructed from a woven or nonwoven material, porous foam, reticulated foam, finely-perforated film web, net materials, natural or synthetic fibers or combinations thereof. Suitable materials include, but are not limited to, bonded carded webs of cotton, polyester, polypropylene, polyethylene, and nylon. Other polyolefins, such as copolymers of polypropylene and polyethylene and linear low-density polyethylene also work well. A particular preferred material is a composite of an apertured thermoplastic film positioned above a nonwoven fabric material. Such composite material can be formed by extrusion of a polymer onto a web of spunbond material to form an integral sheet One example of this is an apertured thermoplastic film bonded to a spunbond material. This material exhibits a smooth and soft outer surface which is not irritating to the wearer's skin and yet has a cushioned feel because of it's bulk.

Another preferred material for the cover **12** is a spunbond web of polypropylene. The web can contain from between about 1 percent to about 6 percent of titanium dioxide pigment to give it a clean, white appearance. A uniform thickness of spunbond is desirable because it will have sufficient strength, after being perforated in the longitudinal direction, to resist being tom or pulled apart during use. The most preferred polypropylene webs have a weight of between about 18 to about 40 grams per square meter. An optimum weight is between about 30 to about 40 grams per square meter.

The liquid-permeable cover **12** can also contain a plurality of apertures, not shown, formed therethrough. The apertures can be arranged uniformly or randomly over either the entire surface of the cover **12** or over a portion of the surface of the cover **12**. For example, the apertures can be arranged in a band extending along the central longitudinal x-axis. The band of apertures can run the entire length of the sanitary napkin **10** or be present over only a portion of the overall length. The apertures are intended to facilitate the movement of body fluid which is deposited onto the cover **12** to penetrate down into the absorbent core **16**.

Positioned distally from the cover **12** is the baffle **14**. The baffle **14** is liquid-impermeable but may permit the passage of air or vapor out of the sanitary napkin **10** while blocking the passage of body fluid. The baffle **14** can be made from any material having these properties. The baffle **14** can also be constructed from a material that will block the passage of vapor as well as fluids, if desired. A good material for the baffle **14** is a micro-embossed, polymeric film, such as polyethylene or polypropylene. Bicomponent films can also be used. A preferred material is polyethylene film. Most preferably, the baffle **14** will be comprised of a polyethylene film having a thickness in the range of from about 0.5 mm to about 2.0 mm.

As is depicted in FIG. **1**, the baffle **14** can be cut to a size and shape which will make it coextensive with the cover **12**. When this is done, the cover **12** and the baffle **14** can be bonded in a face to face contact to form a peripheral sealed sanitary napkin. It is also possible to wrap the cover **12** completely around the absorbent **16** and then adhere the cover **12** to the upper surface of the baffle **14**, not shown, producing what is known in the art as a wrapped pad. Alternatively, the baffle **14** can be wrapped up along the side edges of the absorbent **16** and then the cover **12** can be wrapped completely around both the baffle **14** and absorbent **16**, also not shown. These and other variations are known to those skilled in the disposable absorbent article art.

Positioned between the cover **12** and the baffle **14** is the absorbent core **16**. The absorbent core **16** is preferably flexible, compressible, conformable, non-irritating to the wearer's skin, capable of absorbing and retaining body fluids, and desirably is free of or void of any superabsorbent material. By "superabsorbent" it is meant those absorbent materials usually employed in sanitary napkins, diaper, training pants, etc. that are capable of absorbing and retaining fluid several times their own weight. Non-limiting examples of superabsorbents include hydroxy functional polymers, hydrogel-forming polymers, cross-linked copolymers, etc. Such superabsorbents are normally supplied by such companies as Dow Chemical, Hoechst-Celanese, and Stockhausen, Inc.

Referring to FIGS. **1–3**, the absorbent core **16** is generally a multi-layered structure having a first absorbent layer **20** and a second absorbent layer **22**. It should be understood that for purposes of this invention the absorbent core **16** is not

limited to single layers or sheets of material. It is quite possible for the first and second absorbent layers **20** and **22** to be constructed from laminates or combinations of several sheets or webs of the requisite type of materials as described below. Thus, as used herein, the term "layer" includes the singular and plural use of the word. The first absorbent layer **20** is desirably positioned adjacent to and is in liquid communication with at least a portion of the cover **12**. The first absorbent layer **20** and second absorbent layer **22** have an outer boundary **21** and **23**, respectively. Desirably, the outer boundaries **21** and **23** are coextensive. Alternatively, the first absorbent layer **20** can have a length and width dimension greater than that of the second absorbent layer **22** so that the outer boundary **21** of the first absorbent layer **20** extends beyond and projects over the outer boundary **23** of the second absorbent layer **22**, as seen in FIG. **3**.

The first absorbent layer **20** is constructed from a material that consists substantially of hydrophilic wood pulp fibers, also known as a fluff wood pulp and has a caliper or thickness of less than about 3 millimeters. As discussed above, it is known in the art that such fluff wood pulp exhibits excellent fluid wettability but is not wet stable. The present invention provides an absorbent article utilizing the advantage of a wood fluff pulp and increases the wet stability of the fluff wood pulp. Desirably, the fluff wood pulp contains less than 10% by weight of a polymeric composition and preferably, the fluff wood pulp is void of any material, such as a polyolefinic or polymeric composition, that would substantially change the wettability and fluid distribution through the fluff wood pulp having a similar basis weight or density. The first absorbent layer **20** can have a density ranging from about 0.03 grams per cubic centimeter (g/cm^3) to about 0.25 g/cm^3. Desirably, the first absorbent layer **20** has a density ranging from about 0.05 g/cm^3 to about 0.2 g/cm^3.

The second absorbent layer **22**, which preferably is flexible and resilient, is positioned between the baffle **14** and the first absorbent layer **20**. The second absorbent layer **22** is substantially a cellulosic material and preferably, is an uncreped through air dried sheet of cellulosic material (UCTAD) that is void of any polymeric or polyolefinic materials that would substantially change the character of the cellulosic material. The UCTAD material is described in greater detail in U.S. Pat. Nos. 5,048,589 and 5,399,412 and in the entitled each commonly assigned both Kimberly-Clark Corporation, the entire contents of each being incorporated herein by reference and made a part hereof. Since the second absorbent layer is formed from one or more flat, resilient sheets of absorbent UCTAD layers it is excellent in flexibility and can be appropriately deformed without acquiring a bunched, twisted or roped configuration during use or after a fluid insult Alternatively, the second absorbent layer can be made from one sheet of material that is adequately dimensioned to be folded to effectively acquire a multi-layer configuration. Non-limiting examples of this would be an e-fold where one sheet is trifolded, an accordion fold, or zigzagging a sheet of material back and forth to the desired width dimension.

The sanitary napkin **10** also includes two elongated strips **24** and **25** of garment adhesive which are secured to the bottom of the baffle **14**. The adhesive strips **24** and are spaced apart and function to attach the sanitary napkin **10** to the inner crotch portion of an undergarment during use. The garment adhesive **24** and **25** enable the sanitary napkin **10** to be properly aligned and retained relative to the user's vaginal opening so that maximum fluid protection can be obtained.

It should be noted that the two strips of garment adhesive **24** and **25** could be replaced with a single strip if desired. Alternatively, a swirl pattern of adhesive or some other type of adhesive pattern can also be used. The garment adhesive is of such a nature that it will allow the user to remove the sanitary napkin **10** and reposition it on her undergarment if needed. The garment adhesive is commercially available from National Starch and Chemical Company having an office located at 10 Findeme Avenue, Bridgewater, N.J. 08807.

A releasable peel paper **26** protects the two garment adhesive strips **24** and **25** from contamination prior to use. The peel paper **26** can be a white Kraft paper coated on one side so that it can be released from a hot melt adhesive. The peel paper is designed to be removed by the user immediately before she attaches the sanitary napkin **10** onto the inner crotch portion of her undergarment

The sanitary napkin **10** of the present invention generally has a caliper or thickness greater than about 5 millimeters. The caliper of the sanitary napkin **10** is measured without the peel strip **26** and with the adhesive **24** and **25** blocked using talc or cornstarch. The caliper of the sanitary napkin **10** is determined by placing a Lucite block, measuring 12.7 mm by 44.5 mm (0.5 of an inch by 1.75 inches) on top of the sanitary napkin **10**. The thickness is determined with an indicator gauge that measures the distance of the block above a flat surface. The block is placed with one of the 44.5 mm (about 1.75 inch) long edges along one of the long edges of the absorbent core **16** with all of the block itself being on top of the absorbent core **16**. The block is roughly centered along the length of the sanitary napkin **10**. The height of the sanitary napkin **10** plus the block, is then subtracted from the height of the block alone on the surface, to give the thickness or caliper of the sanitary napkin **10**.

The absorbent core **16** of the present invention must be resilient when wet so that when a lateral compressive force, or crushing force, is removed the sanitary napkin **10** will substantially return to its original size and shape. For the purpose of the present invention, resiliency is determined by the wet crush width recovery of the absorbent core **16**. Desirably, the absorbent core **16** has a wet crush width recovery greater than about 70 percent, preferably, the absorbent core **16** has a wet crush width recovery greater than about 80 percent, and more preferably, the absorbent core **16** has a wet crush width recovery greater than about 90 percent Referring to FIGS. **4** and **5**, the wet crush recovery value is determined according to the procedure below.

All of the absorbent articles to be tested should be acclimated for at least two hours in a controlled environment at a temperature of 23° C.+1° C.(73.4° F.+1.8° F.) and a relative humidity of 50+2 percent.

The "wet crush width recovery" value is measured using an apparatus **104** depicted in FIGS. **4** and **5**. The apparatus **104** is designed to retain an absorbent article **106** having a pair of spaced apart longitudinal side edges **108** and **110**. The absorbent article **106** also has an absorbent **107** with a pair of spaced apart longitudinal side edges **109** and **111**. The side edges **109** and **111** can be coincidental with or spaced inward from the longitudinal side edges **108** and **110** of the absorbent article **106**.

Referring to FIG. **4**, a tester **112** is depicted which is capable of measuring the force, in grams, required to crush the absorbent article **106** sideways. By sideways is meant along the transverse central y-axis which is shown in FIG. **1**. The tester **112** includes first and second arms, **114** and **116** respectively, only one of which has to be movable. The first

and second arms **114** and **116** are coaxially aligned and spaced apart. The distance to which the arms **114** and **116** are separated can be varied to accommodate the size of the apparatus **104** and the size of the absorbent article **106** which is to be tested. The tester **112** is capable of moving at least one of the arms **114** and/or **116** relative to the other arm at a predetermined speed. One common tester which can be used is a SINTECH® 1/S which is available from Sintech, a division of MTS Systems Corp. having an office at 1400 Technology Drive, Eden Prairie, Minn. 55344. A commercially available, alternative tester is an INSTRON® tester available from Instron Corporation having an office at 100 Royall Street, Canton, Mass. 02021.

The apparatus **104** includes a first frame member **118** and a second frame member **120** which are interleaved to operate in unison. The first frame member **118** and second frame member **120** are reciprocally movable relative to one another. Both of the frame members, **118** and **120** respectively, can be rectangular in configuration. Other shapes may work equally as well. The first frame member **118** has a first plate **122** with an inner surface **124** and an outer surface **126**. The first frame member **118** also has a second plate **128** with an inner surface **130** and an outer surface **132**. The first and second plates, **122** and **128** respectively, are joined together by at least two support members **134** and **136**, and preferably, by four support members.

In FIGS. **4** and **5**, four support members are actually present but only the two support members, **134** and **136** respectively, are visible. The remaining two support members are located directly behind and at a distance from the two support members **134** and **136**. When four support members are present, they can be arranged in a rectangular fashion such that each is connected to a comer of the first and second plates, **122** and **128** respectively.

Secured to or formed on the inner surface **130** of the second plate **128** is a shoulder **138**. The shoulder **138** can have an arcuate shape and more preferably a semi-circular configuration having a radius of about 76 millimeters (about 3 inches). The semi-circular configuration of the shoulder **138** should have a smooth profile which contacts the central section of the longitudinal side edge **110** of the absorbent article **106**. The shoulder **138** should have a fixed width depending upon the thickness of the absorbent article **106**. The width of the shoulder **138** is measured along a line extending perpendicular to the plane of the sheet illustrated in FIG. **4**. The shoulder **138** should have a width of about 11 mm for an absorbent article which has a thickness or caliper ranging from between about 2 mm to about 7 mm. The shoulder **138** should have a width or thickness of about 17 mm. A method of measuring the thickness of an absorbent article **106** is described above.

Extending outwardly from the shoulder **138** is at least one, preferably two, and more preferably three or more wands **140**, **142** and **144**. Each wand **140**, **142**, and **144** can be secured to the shoulder **138** and/or to the second plate **128** by a common fastener, for example by a pair of screws **172**, as shown. Other fasteners, such as bolts, nuts, rivets, pins, etc. can also be used, as well as attachment by welding, fusion, adhesive, etc. These and other methods of attaching or securing the wands **140**, **142** and **144** to the shoulder **138** and/or the first plate **122** are known to those skilled in the art.

The wands **140**, **142** and **144** should be flexible members so as to be capable of bending outwardly as the absorbent article **106** gets thicker as it is crushed along the y-axis. The wands **140**, **142** and **144** can be constructed of a pliable or bendable material such as plastic or rubber or they can be made from thin pieces of metal, wood, etc. For measuring the "wet crush recovery" value of a thin absorbent article, like a sanitary napkin, each wand **140**, **142** and **144** can be a thin plastic strip having a length of about 89 mm (about 3.5 inches), a width of about 19 mm (about ¾ of an inch) and a thickness of about 1.6 mm (about 1/16 of an inch). The exact dimension can vary to suit one's particular absorbent article. Each wand **140**, **142** and **144** extends outwardly toward the first plate **122**. The wands **140**, **142** and **144** can be oriented parallel to one another and can be spaced apart so as not to interfere with one another. In FIGS. **4** and **5**, the wands **140** and **144** are secured to one side of the shoulder **138** while the wand **142** is secured to the opposite side of the shoulder **138**. This allows the wands **140**, **142** and **144** to be offset from one another.

The second frame member **120** can be constructed to be very similar to or identical in configuration to the first frame member **118** except that it will have to be of a slightly different size so as to permit the two frame members **118** and **120** to be interleaved. By "interleaved" is meant that the first frame member **118** is assembled in such a fashion with the second frame member **120** that one can move relative to the other while being separated therefrom. The second frame member **120** has a third plate **148** with an inner surface **150** and an outer surface **152**. The second frame member **120** also has a fourth plate **154** with an inner surface **156** and an outer surface **158**. The third and fourth plates, **148** and **154** respectively, are joined together by at least two support members **160** and **162**, and preferably, by four support members. The fourth plate **154** is so sized and shaped so as to be able to slide between the first and second plates, **122** and **128** respectively, of the first frame member **118**.

In FIGS. **4** and **5**, four support members are actually present but only the two support members **160** and **162** are visible. The remaining two support members are located directly behind the two support members **160** and **162**. When four support members are present, they can be arranged in a rectangular fashion such that each is connected to a comer of the third and fourth plates, **148** and **154** respectively.

Secured to or formed on the inner surface **156** of the fourth plate **154** is a shoulder **164**. The shoulder **164** can be arcuate in shape. More preferably, the shoulder **164** can have a semi-circular configuration, and should have a width identical to that described above for the shoulder **138**. Extending outwardly from the shoulder **164** is at least one, preferably two, and more preferably three or more wands **166**, **168** and **170**. Each wand **166**, **168**, and **170** can be secured to the shoulder **164** and/or to the fourth plate **154** by a common fastener, for example a pair of screws **172**, as shown. Other fasteners, such as bolts, nuts, rivets, pins, etc. can also be used, as well as attachment by welding, fusion, adhesive, etc. These and other methods of attaching or securing the wands **166**, **168** and **170** to the shoulder **164** and/or the fourth plate **154** are known to those skilled in the art.

The wands **166**, **168** and **170** can be similar or identical to the wands **140**, **142** and **144** discussed above. Each of wands **166**, **168** and **170** extends outwardly toward the third plate **148**. The wands **166**, **168** and **170** can be oriented parallel to one another and can be spaced apart so as not to interfere with one another. In FIGS. **4** and **5**, the wands **166** and **170** are secured to one side of the shoulder **164** while the wand **168** is secured to the opposite side of the shoulder **164**. This allows the wands **166**, **168** and **170** to be offset from one another.

The wands **140**, **142** and **144** secured to the first frame member **118** intermesh with but do not physically contact the wands **166**, **168** and **170** secured to the second frame member **120**. However, actual rubbing contact between the wands **140**, **142**, **144**, **166**, **168** and **170** can occur if desired, but is not viewed to be advantageous. When the wands **140**, **142** and **144** engage or intermesh with the wands **166**, **168** and **170**, in a similar fashion as when the fingers on a person right and left hands come together, an opening or defined area is formed into which the absorbent artidce **106** can be inserted. The absorbent article **106** is positioned between the first and second frame members, **118** and **120** respectively. In this position, the wands **140**, **142**, **144**, **166**, **168** and **170** are aligned parallel to one another with the wands **140** and **144** offset from wand **168** while wands **166** and **170** are offset from wand **168**. With the wands **140**, **142**, **144**, **166**, **168** and **170** engaged, there will be three wands located on each side of the absorbent article **106**.

The first frame member **118** further has an attachment mechanism **174**, such as an outwardly extending shaft, secured to the outer surface **132** of the first plate **122**. The shaft **174** can be releasably attached to the first arm **114** of the tester **112**. Likewise, the second frame member **120** has an attachment mechanism **176**, such as an outwardly extending shaft, secured to the outer surface **152** of the third plate **148**. The shaft **176** can be releaseably attached to the second arm **116** of the tester **112**. With the apparatus **104** secured to the tester **112**, movement of at least one of the arms **114** and **116** away from the other will cause the first frame member **18** to move relative to the second frame member **120**. This will cause the two shoulders **138** and **164** to approach one another and squeeze the longitudinal side edges **108** and **110** of the absorbent article **106** thereby crushing the article **106** to a preselected distance between the shoulders **138** and **164**.

The method of operating the apparatus **104** to determine the wet crush recovery of an absorbent article **106** sideways along the y-axis is as follows:

First, the apparatus **104** is secured in the tester **112**, preferably in a vertical orientation. When secured, the first and second frame members, **118** and **120** respectively, of the apparatus **104** are attached to the two arms **114** and **116** of the tester **112**. The first and second frame members, **118** and **120** respectively, are adjusted to be a predetermined distance apart, for example 102 mm (about 4 inches). This setting allows the absorbent article **106** to be positioned between the first and second frame members, **118** and **120** respectively, while still in a planar or non-buckled condition. A pre-calibrated load cell, for example, a 50 pound full scale, tension/compression load cell, is utilized.

Second, any wings, flaps, panels, tabs or appendages which may be attached to or integrally formed with the absorbent article **106** should be removed before the absorbent article **106** is tested. Such laterally extending wings, flaps, panels, tabs or appendages can be removed prior to testing, by cutting them off along a line approximately parallel to the longitudinal side edges **108** and **110** of the absorbent article **106**.

Third, the peel strip should be removed and the garment adhesive should be blocked using cornstarch or talc.

Fourth, the width of the absorbent **107** is measured then the absorbent is wetted with 25 milliliters (ml) of 0.9 percent by weight saline or alternatively, water. This can be done by pouring the saline onto the center of the bodyside surface of the absorbent article **106** at a rate slow enough to allow all of the saline to be absorbed by the article **106**.

Fifth, within 5 minutes after the initial insult, the wetted absorbent article **106** is then centered in the apparatus **104** as indicated in FIG. **4**.

Sixth, the load cell of the tester **112** is zeroed per the manufacturer's instructions.

Seventh, the tester is then actuated causing the arms **114** and **116** to be separated, causing the longitudinal side edges **108** and **110** of the absorbent article **106** to be crushed toward one another between the shoulders **138** and **164**. The crushing force is applied to the sanitary napkin **106** until the width of the absorbent **107**, at its closest point, is approximately 40% of the original, pre-crushed dimensional value.

After the absorbent article **106** has been crushed, the arms **114** and **116** of the tester **112** are retracted to their original pretest position. In this position, the longitudinal side edge **110** of the absorbent article **106** is contacting the first shoulder **138** and the opposite longitudinal side edge **108** is spaced apart from the second shoulder **164**. This arrangement allows the absorbent article **106** to freely recover toward its original transverse dimension. After approximately 30 seconds, the recovered width of the absorbent **107** is measured in millimeters. The recovered width is the distance between the longitudinal side edges **109** and **111** of the absorbent **107**. The "wet crush recovery" value is this measured recovered width divided by the original pre-crushed width multiplied by 100%. This can be represented by the formula:

$$\frac{\text{wet crush recovery width}}{\text{Pre-crushed width of absorbent}} \times 100\%$$

Referring to FIGS. **6** and **7**, another embodiment of an absorbent article is shown illustrated as a sanitary napkin **200**. The sanitary napkin **200** includes a liquid-permeable cover **212**, a liquid impermeable baffle **214** and an absorbent core **216**. The cover **212**, baffle **214** and absorbent core **216** are the same as described above in FIGS. **1–3**. The cover **212** and baffle **214** extend beyond the absorbent core **216** in a contiguous relationship and are sealed together to define a periphery **218** of the sanitary napkin **200**. The absorbent core **216** is generally a multi-layered structure having a first absorbent layer **220** and a second absorbent layer **222**. The absorbent core **216** has a wet crush recovery value, as described above, greater than about 70%, preferably greater than 80% and more preferably, greater than 90%. The first and second absorbent layers **220** and **222** generally have an hourglass shape configuration with coterminous outer boundaries **221** and **223**, respectively.

The first absorbent layer **220** includes an inner boundary **224** defining an acquisition orifice **226**. The acquisition orifice **226** extends through the first absorbent layer **220** allowing the second absorbent layer **222** to be in direct liquid communication with the cover **212** so that liquids deposited on the cover **212** will be quickly acquired into the second absorbent layer **222**. The cover **212** can be joined to the second absorbent layer **222** through the acquisition orifice **226** by use of an adhesive or other attachment means (not shown). Since the first absorbent layer comprises fluff wood pulp having a thickness generally less than about 3 millimeters, the cover **212** does not need to be attached to the second absorbent layer **222** to provide rapid liquid acquisition by the second absorbent layer **222**. The acquisition orifice **226** provides a means through which liquids contacting the cover **212** can migrate down through the acquisition orifice **226** to the second absorbent layer **222** more quickly and will have a reduced tendency to pool on the surface of the cover **212**. The acquisition orifice **226** serves to collect and to distribute to the second absorbent layer **222** substantial amounts of discharged liquid. Such liquids can generally

be discharged in gushes or slowly over long periods of time. Accordingly, the acquisition orifice **226** must be able to quickly acquire and transport liquid from the point of liquid contact to other parts of the absorbent core **216** and preferably to the second absorbent layer **222**.

The shape, size and position of the acquisition orifice **226** is important to the effectiveness of absorbent core **216** rapidly acquiring discharged liquids. In accordance with the present invention, the acquisition orifice **226** has a length, measured along the longitudinal axis X—X, and a width, measured along the transverse axis Y—Y, such that the ratio of the length to the width is greater than one. Desirably, the ratio of length to width is greater than about 2 and preferably, the ratio of length to width is greater than about 4. The acquisition orifice **226** is placed on the sanitary napkin substantially at the location or in the vicinity of the point of discharge of liquids so that it is capable of quickly acquiring such liquids at their contact zone. In a preferred embodiment illustrated in FIGS. **6** and **7**, the acquisition orifice **226** is medially aligned along both the x-axis and the y-axis.

The size of the acquisition orifice **226** can generally be expressed as a percentage of the top surface area of the first absorbent layer **220** since this actually defines the initial area available for liquid absorption. In accordance with the present invention, the top surface of the acquisition orifice **226** preferably comprises less than about 50% of the total top surface area of the first absorbent layer **220**. The "total top surface areas" of the first absorbent layer **220** is measured as if the acquisition orifice **226** were not present and the first absorbent layer **220** is similar to that illustrated in FIGS. **1–3**. More preferably, the top surface area of the acquisition orifice **228** comprises less than about 40% of the total top surface area of the first absorbent layer **220**, with less than about 25% being most preferred. The acquisition orifice **226** can be any desired shape consistent with the absorbent requirement of the absorbent core **216** and meeting the requirements regarding the ratio of length to width delineated above. For example, the acquisition orifice **226** can be rectangular, oblong, hourglass shaped, dogbone shaped or elliptical. It is also understood that the acquisition orifice **226** can be a plurality of smaller orifices positioned so that at least a portion of the total surface area of the orifice is placed in the vicinity of the point of discharge of liquids so as to be capable of quickly acquiring such liquids at their contact zone (not shown).

The sanitary napkin **200** also includes two elongated strips **228** and **229** of garment adhesive similar to that described above for garment adhesive **24** and **25**. A releasable peel paper **230** protects the two garment adhesive strips **228** and **229** from contamination prior to use. The peel paper is similar to that described above for the peel strip **26**.

COMPARATIVE EXAMPLES 1–5

Values for the wet crush recovery of various sanitary napkins having a caliper greater than 5 millimeters were tested as described above. The results appear in Table I below.

TABLE I

Products	Caliper	Initial Width	WRV
NF Maxi[1]	11.6	60	57%
KOTEX ® Maxi[2]	13.4	60	57%
Always Ultra[3]	14.2	60	55%
Always Compact[4]	9.2	55	69%
SureFit Maxi[5]	12.6	45	60%

[1]New Freedom ® Maxi available from Kimberly-Clark Corporation.
[2]KOTEX ® Maxi available from Kimberly-Clark Corporation.
[3]Always Ultra available from Procter & Gamble Company.
[4]Always Compact available from Procter & Gamble Company.
[5]Stayfree ® SureFit Maxi with stayput wings available from Personal Products Company, a division of McNeil-PPC.

EXAMPLES 6–9

Two sanitary napkins were constructed in accordance with the present invention. Codes S and T each had a cover, 470 gsm embossed fluff wood pulp first absorbent layer having a medially positioned, elliptical acquisition orifice with a length of 100 cm and a width of 25 cm. The second absorbent layer was composed of 6 layers of 35 gsm of an UCTAD material. The baffle was a 1 mil polyethylene film material. Two lines of garment adhesive were on the garment side of the baffle which were blocked with cornstarch for the purpose of determining the wet crush recovery according to the procedure set forth above.

The wet crush recovery values for these sanitary napkins are given in Table II below.

TABLE I

Products	Caliper	Initial Width	WRV
Code S	7.7	61	97%
Code T	8.2	60	97%

From the data, it is dear that absorbent article having a fluff wood pulp as at least one of the absorbent layers and constructed in accordance with the present invention exhibits superior wet crush strength when compared to other absorbent artices known in the art.

While the invention has been described with reference to a preferred embodiment and illustrated with regard to a range of optional features, those skilled in the art will appreciate that various substitutions, omissions, changes and modifications may be made without departing from the spirit hereof. Accordingly, it is intended that the foregoing descripton be deemed merely exemplary of the preferred scope of the present invention and not be deemed a limitation thereof.

We claim:

1. An absorbent article comprising:

a) a liquid permeable cover;

b) a liquid impermeable baffle; and

c) an absorbent core positioned between said cover and said baffle,

said absorbent core having a first absorbent layer disposed toward said liquid permeable cover and a second absorbent layer disposed toward said liquid impermeable baffle, said first absorbent layer consisting essentially of a fluff wood pulp and a polymeric material in an amount of less than 10 percent by weight of said first absorbent layer, and said first absorbent layer, having an inner boundary defining an acquisition orifice, said acquisition orifice having a ratio of length to width greater than unity, said second absorbent layer consisting essentially of a resilient cellulosic material, said absorbent article having a wet crush width recovery of greater than about 70 percent.

2. An absorbent article as in claim 1, said first absorbent layer being disposed toward said liquid permeable cover, said second absorbent layer being disposed toward said liquid impermeable baffle. boundary and said second absorbent layer has a second outer boundary.

3. An absorbent article as in claim 1 wherein said first absorbent layer has a density ranging from about 0.03 g/cc to about 0.25 g/cc.

4. An absorbent article as in claim 1 wherein said first absorbent layer has a density of about 0.05 g/cc to about 0.2 g/cc.

5. An absorbent article as in claim 1 wherein said absorbent article has a caliper greater than 5 millimeters and said first absorbent layer has a caliper of less than about 3 millimeters.

6. An absorbent article as in claim 1, the acquisition orifice extending through the entirety of said first absorbent layer.

7. An absorbent article as in claim 1, the acquisition orifice having a length to width ratio greater than 2/1.

8. An absorbent article as in claim 1, the acquisition orifice having a length to width ratio greater than 4/1.

9. An absorbent article as in claim 1 wherein said second absorbent layer consists essentially of uncreped through air dried cellulosic sheet material.

10. An absorbent article as in claim 1, said absorbent article, when crushed so that said absorbent article is approximately 40% of a pre-crushed dimensional width of said absorbent article, having a wet crush width recovery such that the recovered width, approximately 30 seconds after said absorbent article is allowed to recover, is greater than about 70 percent of the pre-crushed dimensional width of said absorbent article.

11. An absorbent article as in claim 10 wherein the recovered width is greater than about 80 percent.

12. A sanitary napkin, comprising:

a) a liquid permeable cover;

b) a liquid impermeable baffle; and

c) an absorbent core positioned between said cover and said baffle, said absorbent core having a first absorbent layer disposed toward said liquid permeable cover and a second absorbent layer disposed toward said liquid impermeable baffle, said first absorbent layer consisting essentially of a fluff wood pulp, and said second absorbent layer having an inner boundary defining an acquisition orifice extending through said first absorbent layer such that said permeable cover is directly exposed to said second absorbent layer at the orifice,

wherein when said sanitary napkin is crushed to approximately 40% of a pre-crushed dimensional width of said sanitary napkin, said sanitary napkin has a wet crush width recovery such that a recovered width, approximately 30 seconds after said sanitary napkin is allowed to recover, is greater than about 70 percent of the pre-crushed dimensional width of said sanitary napkin.

13. A sanitary napkin as in claim 12 wherein the size of the acquisition orifice comprises less than about 50% of a total top surface area of said first absorbent layer.

14. A sanitary napkin as in claim 12 wherein the size of said acquisition orifice comprises less than about 25% of a total top surface area of said first absorbent layer.

15. A sanitary napkin as in claim 12, said acquisition orifice being medially aligned along both a longitudinal x-axis and a transverse y-axis.

16. A sanitary napkin as in claim 12, said second absorbent layer comprising one or more layers.

17. A sanitary napkin as in claim 16, said one or more layers consisting essentially of uncreped through air dried cellulosic material.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,245,962 B1
DATED : June 12, 2001
INVENTOR(S) : Muhs et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 2,
Line 34, delete "as."

Column 3,
Line 63, after "sheet" insert -- . --

Column 4,
Line 7, delete "tom" and substitute -- torn --.

Column 5,
Line 44, delete "and."
Line 45, delete "in the entitled each" and substitute -- both --
Line 45, delete "both" and substitute -- to --.
Line 46, delete "each" and substitute -- both --.
Line 52, after "insult" insert -- . --
Line 61, after "and" insert -- **25** --.

Column 6,
Line 9, delete "Findeme" and substitute -- Finderne --.
Line 17, after "undergarment" insert -- . --.
Line 46, after "percent" insert -- . --.

Column 7,
Line 8, delete "SINTECH®" and substitute -- sintech® --.
Line 8, delete "Sintech" and substitute -- SINTECH --.
Line 34, delete "comer" and substitute -- corner --.

Column 8,
Line 40, delete "comer" and substitute -- corner --.

Column 9,
Line 29, delete "**18**" and substitute -- **118** --.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,245,962 B1
DATED : June 12, 2001
INVENTOR(S) : Muhs et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 11,
Line 33, delete "**228**" and substitute -- **226** --.

Column 12,
Line 47, delete "descripton" and substitute -- description --.

Column 13,
Line 4, delete "boundary and said second absor-."
Line 5, delete "bent layer has a second outer boundary."

Signed and Sealed this

Second Day of April, 2002

Attest:

JAMES E. ROGAN
Director of the United States Patent and Trademark Office

Attesting Officer